Abstract

Adaptation to climate change of the Sixt-Fer-à-Cheval / Passy National Nature Reserve

VULNERABILITY ASSESSMENT AND ADAPTATION PLAN

BACKGROUND

The Sixt-Fer-à-Cheval/Passy National Nature Reserve was created in 1977 and covers an area of 9 445 ha. It is part of a continuum of approximately 15 000 ha with 4 other high mountain reserves all managed by Asters, the "Conservatoires d'espaces naturels" (CEN) of Haute-Savoie (France).

The specificity of the site lies in its extremely diverse mosaic of habitats due to a significant altitudinal gradient (900 m to 3 098 m) and a complex geography notably inherited from the last glaciation (glacial cirques, hanging valleys, valley and glacial peak). Karst dissolution, water, gravity movements, vegetation and human activities shape the landscape of this site known as the water reservoir of the Giffre valley. The reserve has 17 habitats of community interest as well as numerous heritage species.

METHOD

The reserve, as part of the LIFE Natur'Adapt project coordinated by Reserves Naturelles de France, is one of the first 6 French protected areas where a method is being tested to assess the vulnerability and opportunities of the climate change at the scale of a site and integrate them into its management.

The assessment crosses sensitivity, exposure and adaptive capacity to climate change of 30 "key objects". It is based on the known effects of climate change in the mountains, but also on stakeholder's knowledge of the territory. This led us to forecast the evolution of the protected area up to 2100 according to two climatic scenarios.

SUMMARY OF THE VULNERABILITY ASSESSMENT

Climatic trends

In the French Alps, an increase of +2°C in the annual atmospheric temperature compared to the beginning of the century is observed. In the nature reserve, average spring temperatures increased by 0.9°C between 1951-1957 and 1976-2005 and summer averages by 0.5°C. In the Northern Alps, the cumulative rainfall stayed stable but the duration of snowfall decreased from 22 to 34 days below 2 000 m between 1971 and 2019.

By 2100, the average daily temperatures of the study area that we used to feel at the altitude of 900 m will be felt at 1 800 m in summer, and even exceeded. The average summer and winter temperatures will then be similar to those currently measured at 1 800 m in the Ubaye from 1976-2005 (RCP 4.5) or could even exceed those of Verdon (RCP 8.5).

The models are divergent on the fate of precipitation and its monthly distribution. However, due to the rise in temperatures, **snowfall volume will decrease sharply below 2.400 m** from November to April, as will the duration of snow cover on the ground.

Probable impacts on the Nature Reserve

- **The remarkable geo-heritage** (glacial cirques, rock walls, karstic network) **will be largely preserved,** except for the braided sector called "Bout du Monde" of the Giffre river. which will probably decrease. The alluvial habitats will be modified by the decrease in sediment and meltwater from the glacier at the head of the watershed.
- **A tiny fraction of the ice volume could be conserved** in a scenario of a rapid global slowdown in GHG emissions[1]. Their disappearance will accentuate the low-water level of the Giffre in summer. But in the

[1] Greenhouse Gas Emissions

long run, this will leave potential conquest surfaces for many species.

- **The water flows will change over time:** less water in summer (less snow and ice, more drought and evapotranspiration) against more water between fall and spring (less precipitation stored as snow). Annual flows should decrease with the disappearance of ice stocks inherited from the past.
- **Habitats associated with wet soils and long-time snow cover** such as mega-spurs, subalpine and alpine grasslands, and snow beds, **are particularly vulnerable.** The possibilities of conquering areas higher in altitude are very limited due to the topography and pastoral practices.
- **Forest species such as beech, spruce and fir will all be vulnerable** to new climatic conditions.
- **The mosaic of habitats will lose in diversity** because under new climatic conditions, the subalpine and alpine levels will rise to the detriment of the rarer snow level.
- **Access to the reserve will be facilitated in time and space,** which suggests an increase in visitors. Conflicts of use could then arise. The risk of disturbing wildlife during the breeding and nesting periods will be accentuated. Additionally, the state of aquatic habitats could deteriorate with visitors looking for fresh sites.
- **Heritage species typical of mountain habitats are threatened** in both the mid and long term. Notwithstanding, they used to help raising public awareness and facilitating acceptance of the regulations. Their disappearance will entail an adaptation of actions and educational discourses both from the nature facilitators than the technical guards.
- The increase of visitors, an easier access to alpine chalets, and the lengthening of the summer period could lead to **an increase in administrative and judicial police actions** (examination of requests for work or the organization of sport events), as well as **awareness raising**. This would weaken the reserve team and complicate the organization of work.

SUMMARY OF THE ADAPTATION PLAN

As the reserve manager is in the process of drafting the management document for the next ten years, **the strategy developed aims to integrate the results of the vulnerability and opportunity assessment the main issues of the site and the choice long-term goals.** We therefore propose, among others, to integrate these future issues into the management plan:

- **Protect of human interventions the hydrological and geomorphological dynamics** that condition the existence and development of habitats in the nature reserve;
- **Promote the geological heritage of the reserve,** which is less vulnerable to climate change, which is a good medium for raising public awareness on the effects of climate change using past climate elements;
- **Allow unmanaged areas of forest and grassland habitats** in order to help their adaptive dynamics;
- **Maintain ecological corridors** all around the reserve and the continuum with 4 other reserves and nearby massifs in order to promote the movement of species to habitats that are favourable to them.

We also suggested to put forward **an increase in the human resources** as a key factor for the success of the next management plan.

CONSULTATION OF ENTIRE DOCUMENTS

Vulnerability assessment (fr)

Annexes (fr)

Adaptation plan (fr)